# GR-9029, BLE5, L1/L2 GNSS RTK Receiver w/ Buttons & Rechargeable Battery

Overview

GR-9029 is a cm-level high-precision GNSS receiver with Bluetooth Low Energy (BLE) communication capability. Under normal open-sky working environment, the precise RTK[!] fix could be achieved in seconds.

GR-9029 is based on **u-blox ZED-F9P** multiband GNSS receiver, integrated with multiband GNSS antenna, BLE5 module & antenna, rechargeable battery, charging circuit, POI button, power switch, and USB-type C interface to make it a self-contained cm-level GNSS receiver.

APP on devices like smartphones, tablets, notebooks etc. could communicate with GR-9029 via BLE to get the RTK precise positions which could be used for precise **measurement**, navigation, data logging etc.
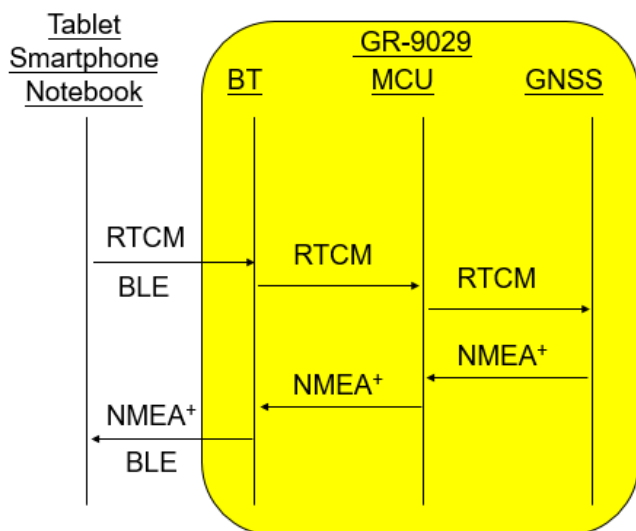
In addition to the receiver, an iOS demo APP could be used for showing the precise positions and moving trace.

A control cable with button on it could be used to control power ON/OFF, tag POI (Point Of Interest) position etc.

[!] GR-9029 plays as a RTK rover and requires calibration data from a private base or a public NTRIP caster. A private RTK base with same architecture is also feasible.

Applications

- Precise positioning
- Precise distance measurement
- Precise route navigation
- Precise data logger

Features

- *Based on high-performance components*
  - ▪ *u-blox ZED-F9P multi-band GNSS*
  - ▪ *BLE5 module with antenna*
  - ▪ *Made in Japan rechargeable battery cell*
- *All in one small compact device*
  - ▪ *Disk with size of Φ116*24.6 (mm)*
- *Magnet mount option with a pedestal*
- *Supported GNSS Constellations*
  - ▪ *GPS: L1C/A, L2C*
  - ▪ *GLONASS: L1OF, L2OF*
  - ▪ *Galileo: E1-B/C, E5b*
  - ▪ *BeiDou (BDS): B1I, B2I*
- Supported Augmentation Systems
  - ▪ QZSS over L1 C/A, L2C, L1S
  - ▪ SBAS (WAAS, EGNOS, MSAS, GAGAN)

- *Accuracy of RTK rover:* 1 cm+1ppm CEP
- High sensitivity[+]:-167dBm tracking/-148dBm acquisition
- Up to 10Hz update rate for quad-GNSS constellation
- OMA SUPL compliant A-GPS support
- BLE 5.2
  - Up to 2 Mbps
  - Advertising extensions
  - Channel Selection Algorithm #2 (CSA #2)
- Rechargeable battery
  - Lithium-ion, 900mAh
  - Charged by USB type-C connector
- A button on control cable for power switch and POI
- LED to indicate working status

Technical Specifications

Receiver Performance Data[+] - u-blox ZED-F9P

Supported GNSS Constellations	GPS/SBAS/QZSS: (MHz)
	   L1 C/A (1575.42),
	   L2C (1227.60)
	GLONASS:
	   L1OF (1602+k*0.5625, k= -7,…,5,6),
	   L2OF (1246+k*0.4375, k= -7,…,5,6),
	Galileo:
	   E1-B/C (1575.42),
	   E5b (1207.140)
	BeiDou:
	   B1I (1561.098)
	   B2I (1207.140)

Position Accuracy (RTK baseline up to 20km; 24 hours static)	Horizontal:
	   RTK: 1 cm+1ppm CEP
	   SBAS: 1 m CEP
	   PVT: 1.5 m CEP
	Vertical: (result with 1km baseline)
	   RTK: 1 cm+1ppm R50

Velocity Accuracy	<0.05 m/s (speed) GPS+GLONASS/BDS <0.3° (heading) GPS+GLONASS/BDS (50% @ 30 m/s for dynamic operation)
Time Pulse Signal	0.25Hz...10MHz RMS: 30ns, 99%: 60ns

Time To First Fix (TTFF)
  Hot start
  Aided start
  Cold start
	Autonomous (All at -130dBm)
	
	2sec (GPS+Glonass+Galileo+BeiDou)
	2sec (GPS+Glonass+Galileo+BeiDou)
	25sec (GPS+Glonass+Galileo+BeiDou)

Sensitivity	GPS+Glonass+Galileo+BeiDou Acquisition: -148 dBm Reacquisition: -160 dBm Tracking & navigation: -167 dBm
Max. Update Rate RTK Convergence Time	a. GPS+Glonass+Galileo+BeiDou b. GPS+BeiDoui c. GPS RTK: 8Hz@a, 15Hz@b, 20Hz@c PVT: 10Hz@a, 25Hz@b, 25Hz@c RAW: 20Hz@a, 25Hz@b, 25Hz@c <10s@a&b, <30s@c Depends on atmospheric conditions, baseline length, GNSS antenna, multipath conditions, satellite visibility and geometry
Moving Base RTK Performance	a. GPS+Glonass+Galileo+BeiDou b. GPS+BeiDoui c. GPS Max. update rate: 8Hz@a, 10Hz@b, 10Hz@c Heading accuracy: 0.4°@a,b,c
Max. Altitude	50,000 m
Max. Velocity	500 m/s
Protocol Support	NMEA 0183 up to v 4.11, ASCII GGA, GLL, GSA, GSV, RMC, VTG, TXT UBX: u-blox proprietary, binary RTCM 3.3: binary

Default Settings	● GNRMC output once per second ● PUBX 10Hz ● Button pressed or not indication

Augmentation System Support	QZSS: Support L1S SLAS
	    Correction data broadcasted on L1
	SBAS:
	    WAAS, EGNOS, MSAS, GAGAN
	DGNSS: RTCM 10403.3
	● Rover mode messages: (RTCM)
	1001~1012, 1033,
	1074, 1075, 1077, 1084, 1085, 1087,
	1094, 1095, 1097, 1124, 1125, 1127
	● Base mode messages: (RTCM)
	1005, 1074, 1077, 1084, 1087, 1094,
	1097, 1124, 1127, 1230, 4072.0, 4072.1

Dynamics	< 4g

⁺ Note. According to IC Spec

BLE Data⁺ - nRF52832

| Band	2.4 GHz ISM
Data Rate	2 Mbps and 1 Mbps Bluetooth LE
Output Power	Programmable: +4 to -20 dBm in 4 dB steps
Sensitivity	-96 dBm Bluetooth LE 1 Mbps -89 dBm Bluetooth LE 2 Mbps
RSSI	1 dB resolution
Link Budget	100 dB

Environmental Data

Operating temperature	-40 ~ 85℃ except battery: -10~60℃
Storage temperature	-40 ~ 85℃

Mechanical Data:

● Φ116*24.6 (mm) for disk without pedestal
● Φ116*56.8 (mm) for disk with pedestal
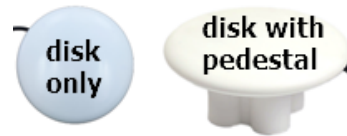
■ Magnet inside pedestal for fixing
● Fixing screw holes, bottom of disk:
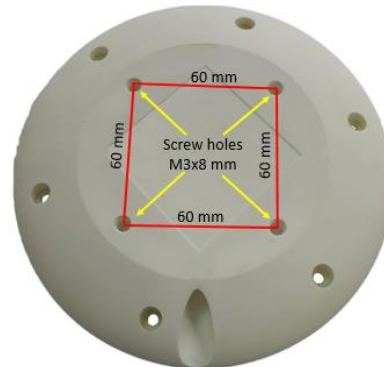
■ E.g. to fix the pedestal with embedded magnets via screw holes.
■ E.g. to fix a metal plate via screw holes and then connect it to a rod or a tripod for measurement.
● Control cable length could be customized

Other Data (For Indicative Reference Only)

Working time	6 hours, fully charged new device
Charging time	1.5 hours with 2A charger
BLE distance	36m line of sight

Interface

- USB type-C connector for charging
- Button
  - Power on: a tapping for power on
  - Power off: hold until LED OFF
  - POI tagging: a tapping as power is on

Ordering Information

GR-9029X:

X=	Pedestal
E	-
Q	V

*This document is subject to change without notice.